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Original Article

Technology-Enhanced English and Management Skill Training for Engineering Employability: An Experimental Study

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Abstract

Engineering graduates increasingly face employability challenges due to gaps in English communication and management skills, despite strong technical knowledge. This study investigates the effectiveness of a technology-enhanced training program designed to improve English proficiency and management competencies among engineering students through an experimental research approach. A pre-test and post-test design was employed to evaluate skill development following structured, technology-mediated instruction integrating communicative language activities and experiential management tasks. Quantitative analysis of comparative mean scores reveals significant improvement in English communication, management skills, and overall employability readiness among participants after the intervention. The findings demonstrate that technology-enhanced learning environments can effectively support holistic employability development when pedagogically aligned with real-world professional demands. This study contributes empirical evidence to the growing body of research on employability-oriented education and offers a scalable model for integrating language and management skill training into engineering curricula.

Introduction

Background of Engineering Employability

In recent decades, engineering education has undergone significant transformation due to rapid technological advancements and globalization of the workforce. Despite possessing strong technical knowledge, many engineering graduates struggle to secure employment because employers increasingly demand skills beyond domain expertise. Reports from global employment studies indicate that communication ability, adaptability, and professional skills are critical determinants of employability, yet these competencies remain underdeveloped among engineering graduates, particularly in developing countries (OECD). The mismatch between academic preparation and industry expectations has made employability a central concern for higher education institutions.

Engineering graduates are now expected to function in multidisciplinary teams, communicate ideas effectively across cultures, and manage professional responsibilities in dynamic work environments. As a result, employability is no longer viewed as an outcome of technical competence alone but as a combination of cognitive, linguistic, and managerial capabilities. This shift has necessitated rethinking pedagogical approaches in engineering education to better align graduate attributes with workplace demands (Yorke).

Importance of English and Management Skills for Engineers

English language proficiency plays a crucial role in the professional success of engineers, as it serves as the primary medium for technical documentation, international collaboration, and professional communication. Engineers frequently engage in activities such as report writing, presentations, client interactions, and cross-border teamwork, all of which require strong command of English. Studies emphasize that inadequate communication skills often hinder otherwise competent engineers from advancing in their careers or performing effectively in professional settings (Graddol).

Alongside language proficiency, management skills such as leadership, teamwork, decision-making, and emotional intelligence have become essential for engineers working in organizational contexts. Modern engineering roles increasingly involve project coordination, people management, and strategic thinking. Employers consistently rank these soft skills as critical hiring criteria, often placing them on par with technical expertise. The World Economic Forum highlights that transferable skills, including communication and leadership, will remain among the most sought-after competencies in the future workforce (World Economic Forum).

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Technology-Enhanced Learning in Higher Education

Technology-enhanced learning has emerged as a powerful approach to address skill gaps in higher education by integrating digital tools into teaching and learning processes. This approach includes the use of learning management systems, mobile applications, virtual collaboration platforms, and AI-assisted feedback mechanisms to enhance learner engagement and autonomy. Research indicates that technology-mediated instruction supports personalized learning, continuous assessment, and experiential engagement, which are particularly effective for language acquisition and skill-based training (Laurillard).

In the context of English and management skill development, technology provides opportunities for interactive practice, real-time feedback, and simulated professional environments. Online discussions, virtual presentations, collaborative projects, and digital simulations enable learners to practice authentic workplace communication and managerial tasks. Such environments bridge the gap between theoretical learning and practical application, making technology-enhanced learning a promising strategy for employability-focused education (Bates).

Research Gap and Need for the Study

Although previous studies have independently explored technology-assisted language learning and digital tools for management education, limited empirical research has examined their combined impact on engineering employability through experimental methods. Many existing studies focus on perception-based outcomes rather than measurable skill development, and few adopt controlled experimental designs to assess effectiveness. Additionally, there is a lack of context-specific research addressing engineering students in non-native English-speaking environments, where employability challenges are more pronounced (Binkley et al.).

This study addresses these gaps by implementing and evaluating a structured, technology-enhanced training program that integrates English communication and management skills. By adopting an experimental design, the research provides empirical evidence on how such interventions influence skill development and employability readiness among engineering students.

Objectives and Significance of the Study

The primary objective of this study is to examine the effectiveness of technology-enhanced English and management skill training in improving engineering students' employability. By focusing on both linguistic and managerial competencies, the study aims to present a holistic model of employability development. The findings are expected to contribute to academic research by providing experimental evidence and to educational practice by offering a scalable training framework for engineering institutions.

The significance of this study lies in its potential to inform curriculum design, teaching methodologies, and policy decisions in engineering education. As higher education institutions strive to enhance graduate employability, evidence-based interventions that leverage technology can play a critical role in bridging the gap between academic learning and industry expectations (Knight and Yorke).

Literature Survey

Engineering Employability and Skill Expectations

Employability in engineering education has been widely discussed as a multidimensional construct encompassing technical knowledge, professional skills, and personal attributes. Researchers emphasize that while engineering curricula traditionally focus on disciplinary expertise, employers increasingly expect graduates to demonstrate communication ability, teamwork, adaptability, and leadership. Knight and Yorke argue that employability should be embedded within the curriculum rather than treated as an add-on, as transferable skills develop through sustained learning experiences rather than isolated training interventions (Knight and Yorke).

Several empirical studies highlight the persistent gap between employer expectations and graduate preparedness. Engineering employers frequently report dissatisfaction with graduates' ability to articulate ideas clearly, collaborate effectively, and manage workplace responsibilities. These deficiencies have been identified as major contributors to graduate unemployment or underemployment, particularly in regions where English is not the primary language of instruction or professional communication (Harvey).

English Language Proficiency in Engineering Education

English language competence is recognized as a foundational skill for engineers operating in global and multicultural professional environments. Research in English for Specific Purposes (ESP) demonstrates that engineering students require proficiency not only in general English but also in technical writing, professional presentations, and workplace discourse. Graddol notes that English has become the dominant language of science, technology, and international business, making language proficiency a key determinant of career mobility and professional success (Graddol).

Studies examining language deficits among engineering graduates indicate that traditional classroom-based language instruction often fails to address real-world communicative demands. Chapelle highlights that meaningful language learning occurs when learners engage in authentic, task-based activities supported by technology. Technology-mediated language learning environments enable learners to practice speaking, writing, and professional communication in contexts that closely resemble workplace situations, thereby improving functional language competence (Chapelle).

Management and Soft Skill Development for Engineers

Management skills such as leadership, teamwork, decision-making, and emotional intelligence are increasingly integral to engineering roles, especially in project-driven and organizational settings. Mintzberg argues that effective managers develop competence through experience and reflection rather than through theoretical instruction alone, a principle that applies equally to engineers transitioning into leadership roles (Mintzberg). As engineering graduates advance in their careers, their success depends on their ability to manage people, resources, and complex systems.

Research on soft skill development suggests that experiential and collaborative learning approaches are most effective in fostering managerial competencies. Kolb's experiential learning theory emphasizes learning through concrete experience, reflection, conceptualization, and experimentation. Digital platforms that support simulations, role-playing, and collaborative projects provide opportunities for engineering

students to develop management skills in realistic yet controlled learning environments (Kolb).

Role of Technology-Enhanced Learning in Skill Development

Technology-enhanced learning has been extensively studied for its ability to transform higher education by enabling flexible, interactive, and learner-centered pedagogies. Laurillard conceptualizes learning technologies as tools that support dialogue, practice, and feedback, which are essential for skill acquisition. In language and management education, technology enables repeated practice, peer interaction, and immediate feedback, which are difficult to achieve in traditional classroom settings (Laurillard).

Empirical studies demonstrate that digital learning environments positively influence learner motivation and engagement. Bates argues that technology, when pedagogically aligned, can enhance the development of higher-order skills such as communication, collaboration, and problem-solving. Learning management systems, video conferencing tools, and collaborative platforms allow students to work in teams, present ideas, and reflect on their performance, thereby supporting employability-oriented learning outcomes (Bates).

Experimental and Empirical Studies on Employability Training

Experimental research designs provide robust evidence for evaluating the effectiveness of educational interventions aimed at skill development. Creswell emphasizes that pre-test and post-test experimental models allow researchers to establish causal relationships between interventions and learning outcomes. In the context of employability training, experimental studies have demonstrated measurable improvements in communication skills, teamwork, and self-efficacy among students exposed to structured skill development programs (Creswell).

Despite these findings, the literature reveals a scarcity of experimental studies that integrate English language training and management skill development within a single technology-enhanced framework for engineering students. Most studies examine these domains independently, leaving a gap in understanding their combined impact on employability. This study builds on existing research by adopting an experimental approach to evaluate a holistic, technology-mediated training model that addresses both linguistic and managerial competencies.

Research Methodology

Research Design

This study adopts an experimental research design to examine the effectiveness of technology-enhanced English and management skill training on engineering students' employability. Experimental designs are widely regarded as robust methods for establishing causal relationships between educational interventions and learning outcomes. By employing a pre-test and post-test approach, the study systematically compares learner performance before and after the intervention, allowing for objective measurement of skill development attributable to the training program. Creswell emphasizes that such designs enhance internal validity and reduce bias in educational research (Creswell).

Participants and Research Context

The participants of this study consist of undergraduate engineering students enrolled in a technical institution where English is taught as a second language. The selection of participants ensures homogeneity in terms of academic background and exposure to technical education, thereby minimizing extraneous variables that could influence the outcomes. Cohen et al. highlight that carefully defined research contexts and participant characteristics are essential for the reliability and generalizability of experimental findings in educational studies (Cohen et al.).

The institutional setting provides a relevant context for examining employability-oriented skill development, as engineering students are expected to transition into professional environments that demand strong communication and management competencies. This context enables the study to reflect realistic educational and employability challenges faced by engineering graduates.

Training Intervention and Instructional Framework

The intervention implemented in this study consists of a structured technology-enhanced training program integrating English communication and management skill development. The instructional framework is informed by principles of experiential learning and communicative language teaching, emphasizing active participation, collaboration, and reflective practice. Kolb's experiential learning theory supports the design of activities that allow learners to engage in real-world tasks, reflect on their experiences, and apply newly acquired skills in varied contexts (Kolb).

Technology serves as the medium through which instructional content is delivered and practiced. Learning management systems, digital communication platforms, and collaborative tools facilitate synchronous and asynchronous interactions, enabling learners to engage in authentic communication and managerial scenarios. Bates notes that effective technology integration enhances learner engagement when aligned with pedagogical objectives rather than serving as a mere content delivery mechanism (Bates).

Data Collection Instruments

Data collection in this study employs multiple instruments to capture changes in English proficiency, management skills, and employability perception. Language assessment tools are designed to evaluate speaking, writing, and professional communication competencies relevant to engineering contexts. Brown emphasizes that valid and reliable language assessment must align with instructional objectives and real-world language use (Brown).

Management skill development is assessed through structured rubrics that measure teamwork, leadership, and decision-making abilities demonstrated during training activities. Additionally, employability perception questionnaires are administered to capture students' self-reported confidence and readiness for professional roles. The use of multiple instruments enhances data triangulation and strengthens the credibility of the research findings.

Data Analysis Procedures

The data collected from pre-tests and post-tests are analyzed using quantitative statistical techniques to determine the effectiveness of the intervention. Comparative analysis of mean scores enables the identification of significant improvements in language and management skills following the training program. Field notes that statistical analysis in educational research allows for objective interpretation of learning outcomes and supports evidence-based conclusions (Field).

Qualitative feedback obtained from participant reflections

and instructor observations complements quantitative findings by providing contextual insights into learner experiences. The combination of quantitative and qualitative analysis ensures a comprehensive understanding of the impact of technology-enhanced training on engineering employability.

Ethical Considerations

Ethical standards are maintained throughout the research process to ensure participant confidentiality, voluntary participation, and informed consent. Participants are informed about the purpose of the study and assured that their academic evaluation will not be influenced by participation. Cohen et al. stress that ethical rigor is fundamental to educational research, as it safeguards participant rights and enhances the integrity of research outcomes (Cohen et al.).

Implementation of the training program

Overview of the Training Program

The technology-enhanced training program was implemented over a defined academic period to support the development of English communication and management skills among engineering students. The program was designed to complement existing coursework while emphasizing practical, employability-oriented competencies. Technology was used not merely as a delivery mechanism but as an enabler of interaction, reflection, and experiential learning, aligning with contemporary pedagogical frameworks in higher education (Bates).

Implementation of English Skill Training

The English skill component focused on enhancing students' professional communication through technology-mediated activities such as digital presentations, structured writing tasks, and interactive discussions. These activities were designed to simulate workplace communication scenarios, allowing learners to practice language use in authentic contexts. Laurillard emphasizes that technology-supported dialogue and feedback are central to effective language learning, particularly when learners engage in meaningful communication tasks (Laurillard).

Implementation of Management Skill Training

The management skill component emphasized teamwork, leadership, and decision-making through collaborative digital tasks and scenario-based learning activities. Students worked in virtual teams to address problem-solving situations that reflect real organizational challenges. Kolb's experiential learning framework underpins this approach, as learners actively engaged in experiences that required reflection and application of management concepts (Kolb).

Role of Technology in Program Delivery

Technology played a central role in facilitating interaction, collaboration, and assessment throughout the training program. Learning management systems supported content access and progress tracking, while digital communication platforms enabled real-time collaboration and feedback. According to Salmon, structured online facilitation enhances learner engagement and supports skill development when guided by purposeful instructional design (Salmon).

Results and discussion

Outcomes of English Skill Development

The analysis of pre-test and post-test results indicates a noticeable improvement in English communication skills among students who participated in the technology-enhanced training program. Learners demonstrated greater clarity in oral presentations and improved organization and accuracy in written communication. These findings align with previous research suggesting that technology-mediated language learning environments facilitate active engagement and contextualized practice, leading to improved language proficiency (Ellis). The results confirm that exposure to authentic communication tasks supported by digital tools enhances functional language use relevant to engineering contexts.

Outcomes of Management Skill Development

The findings reveal positive development in management-related competencies such as teamwork, leadership awareness, and problem-solving ability. Students exhibited improved collaboration and more structured decision-making during group activities conducted through digital platforms. Goleman's work on emotional intelligence supports the observation that interpersonal and self-management skills can be effectively developed through experiential and reflective learning approaches, particularly when learners engage in interactive and socially mediated tasks (Goleman).

Impact on Employability Readiness

Participants reported increased confidence in their ability to meet workplace communication and professional expectations following the intervention. The enhancement in self-perceived employability suggests that integrating English and management skill training through technology can positively influence students' readiness for employment. Harvey notes that employability is closely linked to learners' confidence

Table: *Comparison of Pre-Test and Post-Test Mean Scores*

Skill Area	Pre-Test Mean	Post-Test Mean
English Communication	56.2	72.5
Management Skills	52.8	70.3
Employability Readiness	54.1	73.0

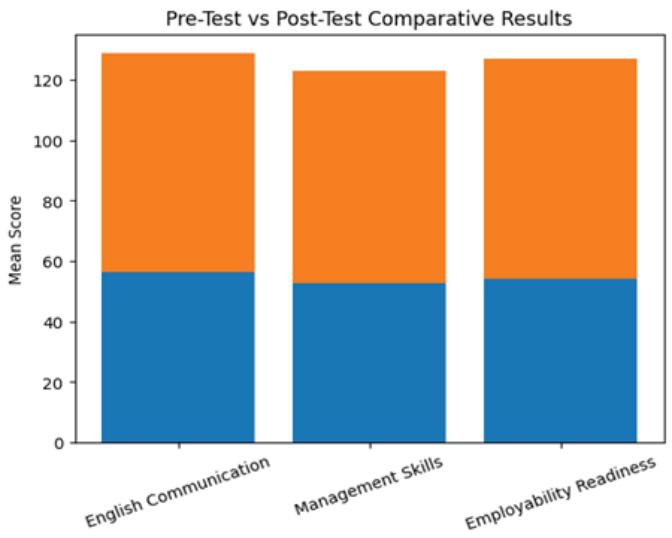

Figure: *Comparison of Pre-Test and Post-Test Mean Scores*

and perceived capability to function effectively in professional environments, reinforcing the significance of skill-oriented interventions in higher education (Harvey).

Discussion of Findings

The results of the study support existing literature that emphasizes the effectiveness of technology-enhanced learning in developing both communication and management skills. By integrating these competencies within a single training framework, the study demonstrates a holistic approach to employability development in engineering education. Biggs and Tang argue that learning outcomes are most effectively achieved when teaching methods, learning activities, and assessment are constructively aligned, a principle reflected in the observed outcomes of this intervention (Biggs and Tang).

Conclusion

The present study confirms that technology-enhanced English and management skill training can significantly improve engineering students' employability readiness. By integrating language development and managerial skill-building within an experiential, technology-supported framework, the intervention addressed critical skill gaps identified in engineering education. The observed improvements in communication ability, teamwork, leadership awareness, and self-perceived employability underscore the value of adopting holistic and learner-centered approaches in higher education. These findings highlight the potential of technology-enhanced learning to bridge the gap between academic preparation and industry expectations, suggesting that such interventions should be systematically embedded within engineering curricula to better prepare graduates for professional success.

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